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To the FCC OET:

(Links to studies in this comment are hereby incorporated by reference)

I am writing to state my objection to your proposed new rules in FCC Docket 19-226, which are covered in [FCC-19-126A1.pdf](#). I am a mother of two children, who have both been injured by cell towers next to their school and wireless technology at school beginning 2013, when they were only 9 years old and 5 years old at the time. I have not been able to return to my previous career as a chemical engineer because tending to their health and educational needs has required my full attention. I have also written to the FCC on previous occasions since 2016 objecting to the FCC's radiofrequency guidelines because of health effects that occur even below its guidelines.

It's been decades, yet the FCC has still not established any safety standards for chronic radiofrequency exposures, and continues to hide behind its outdated thermal guidelines. The new rules continue to deny **non-thermal effects**, average power measurements instead of limiting **peak power which cause effects**. The FCC has continued to erroneously focus on **power and heating versus [pulsation and modulation](#)** which are the determining factors of biological effects. FCC is doing this to accommodate manufacturers, who claim that the current rules constrain their ability to offer "increased data capacity for consumer devices," particularly for devices used close to the body such as notebooks and tablets. Manufacturers are claiming that they will build in the capability for the device itself to measure and regulate its own radiation output, by "device-based-time-averaging." (paragraphs 131-135) [Phones have also been discovered to exceed the current exposure limits beginning in 2018](#) resulting in [recalls](#), and recently [a lawsuit was filed against Apple for iPhones](#) exceeding the FCC limits.

The increase in exposure guidelines for power density to allow 4000 uW/cm<sup>2</sup> (= 4 mW/cm<sup>2</sup>) for 1 cm<sup>2</sup> of tissue (paragraphs 127-128) from the current 1000 uW/cm<sup>2</sup> for 30 minutes (which is already a thermal guideline) and the replacement of this higher power density for **SAR** will increase radiation exposures significantly, even allowing for local heating of tissues. Currently the exposure limit is 1000 uW/cm<sup>2</sup> for 30 minutes, but the new rules will allow 4000 uW/cm<sup>2</sup> (= 4 mW/cm<sup>2</sup>) for 1 cm<sup>2</sup> of tissue INDEFINITELY for an unlimited period of time for any tissue of the body, which would include skin, brain, eyes, organs, etc, and which would apply to EVERYONE, including vulnerable populations, such as children, elderly, and those who are already electrosensitive. The 1000 uW/cm<sup>2</sup> for 30 minutes limit has been in place since 1996. Raising it now, over 20 years later, it is obvious that the FCC is doing so only because it is a "captured agency" whose main interest is to serve the industry it is supposed to regulate [http://ethics.harvard.edu/files/center-for-ethics/files/capturedagency\\_alster.pdf](http://ethics.harvard.edu/files/center-for-ethics/files/capturedagency_alster.pdf) 5G and 6G devices and their infrastructure are expected to exceed the current limits, and in order for the telecommunications industry to be complaint, the FCC will raise its already high exposure limits to assist their cronies, despite all the relevant science to date on human health and safety below the current exposure guidelines.

How would you like to take a medication whose safety standards have been lowered by the FDA in order to assist the drug manufacturer because the manufacturer couldn't meet the current safety standards, while ignoring studies which have shown health effects even below the current safety

standards? This would be government malfeasance, especially heinous because it would be coming from the agency charged with regulation of the industry, and yet the FCC's proposal is analogous to this unethical scenario.

The exposure limits should be protective of all, including worst case scenarios. The worst case scenario would be bedridden, elderly individual who would remain in the same spot 24 hours a day, every day with a cell tower just several feet outside his window.. Would exposing such a person to 4000 uW/cm<sup>2</sup> averaged over 1 cm<sup>2</sup> of tissue indefinitely (paragraphs. 127-128 of [FCC-19-126A1.pdf](#)), for years, from a small cell tower outside his window cause no harmful effects? Have you done studies to confirm that there are no harmful effects in this situation, or which studies have you read that indicate there are no harmful effects in this situation? What about an infant who spends most of his day in a crib with a small cell tower a few feet from his window? Would exposing an infant to localized heating of his skin or eyes for hours a day, every day be safe? What is worse is that these individuals would not be able to verbalize that they felt any pain or discomfort from such exposures to obtain help, and they would not be able to move away from such exposures. These situations are not rare, but actually quite common.

In 2013, my oldest son, who was only 9 at the time, became ill from cell towers installed right next to his school. Since that exposure, he became sensitized to wireless radiation, particularly school wi-fi. His symptoms when exposed to wireless radiation included insomnia, digestive problems, severe allergies, painful skin rashes, headaches, and other neurological and immunological symptoms. (I have physician diagnosis and proof that his illness was caused by wireless radiation) His reaction to wi-fi and cell tower radiation has become so severe that our lives have changed forever - from choosing the location of our home and schools (to avoid cell towers) to avoiding areas with high levels of wireless radiation such as public parks with cell towers. My younger son developed problems as well, but to a lesser degree (because of his shorter exposure time to the school cell towers). The pain and suffering my son, who was only 9-years old at the time, endured was unbearable, and no one, not a child or adult, should have to suffer what he's been through. With increased exposure limits, there will be more children and more adults who may suffer the same symptoms for the first time, and my son's symptoms will surely increase. Since 2016, I have had to homeschool my children off and on for health reasons caused by high radiofrequency exposures at their schools from wi-fi, smart phones and other wireless devices. I had to begin homeschooling out of necessity. My husband, who has a PhD in Chemical Engineering, and I had both hoped that our boys would pursue a career in science, engineering or medicine, but now that they become very ill and cannot function in the presence of significant wireless radiation, how will they attend college when just about every college campus has a cell tower and uses wi-fi, which will only increase with the FCC's proposal to increase exposure levels further to accommodate 5G and 6G? With FCC's support to the telecommunications industry to put small cell antennas on every residential street, that would allow higher exposure levels of 4000 uW/cm<sup>2</sup> indefinitely, from the current limit of 1000uW/cm<sup>2</sup> for 30 minutes for frequencies 1.5GHz and above <https://www.gpo.gov/fdsys/pkg/CFR-2002-title47-vol1/pdf/CFR-2002-title47-vol1-sec1-1310.pdf> (this is not a chronic exposure limit, but a short-term one intended to protect people from burns), how will my boys be able to live safely at home? We're already staying home as much as possible to avoid high exposures in many public places, they cannot attend school in

their home district because they get very sick, and we avoid travel. Home is their only refuge, and the FCC's new proposal could take that away from them too.

**Meo 2019** showed that boys aged 13-16 had cognitive problems (*significant impairment*" in motor skills, spatial working memory and attention) after exposure to high levels of cell tower radiation at school compared to another group of boys with 5 times lower power density exposure.

**Tuengler, 2013** showed that in those with electrosensitivity, the electrosensitivity can objectively measured with 3 parameters that change after wireless radiation exposure. In those without electrosensitivity, the 3 parameters did not change after exposure. (Fig. 4 in the study showed what they were before exposure in ES people, and then Fig. 5 showed the changes after exposure in ES people.) They are: 1) HRV (heart rate variability), 2) electric skin potential, and 3) microcirculation. Microcirculation regulates intestinal motility (see p. 5 of the study), which would impact digestion issues. Changes in electric skin potential could lead to skin reactions and skin sensations.

**Puri, 2019** showed that human lymphocytes reacted to electric field exposure with increasing concentrations of intracellular calcium, which was responsible for increased allergic reactions.

An **IEEE article by Naren et al, 2020** presents a summary of the most prominent health hazards with wireless radiation is presented, along with protective and preventive measures to reduce the risk of EMR absorption, and analyses of radiation safety in pre-5G networks and raises concerns regarding safety in 5G networks. *"[T]he current population has already been exposed to dangerous levels of radiation and the resulting adverse health effects may surface in people at any time.. it must be noted that the radiation in 5G networks is suspected to increase by several folds. It will not only affect regions near cell towers and 5G devices but all indoor and outdoor environments in the region of coverage. Thus, almost all people in the area of coverage of 5G networks may be exposed to dangerous levels of EMR...People should be made aware that the EMR from using day to day cellular, Wi-Fi and Bluetooth devices are harmful to human health...According to the current medical literature, various adverse health effects from exposure to RF EMR have been well documented. For now, wireless technologies must be avoided as much as possible. New and innovative wired solutions ... should be encouraged. Intervention of government and medical bodies with the main purpose of protecting human health is of utmost necessity... Countries must adopt the guidelines suggested by medical bodies which take into account both thermal and non-thermal effects of EMR."*

My children have been made sick with the myriad of symptoms as mentioned above by 4G, but I will focus on the effect of wireless radiation on skin in this comment, because the new proposed limits allow local tissue heating to the skin and eyes, and because my sons already exhibit skin reactions to wireless technology at the current exposure limits of 1000 uW/cm<sup>2</sup> for 30 minutes which are lower. I've attached pictures of my son's skin reactions to cell towers and Wi-Fi, so you can see this for yourself. My son can actually feel his skin burning and hurting and tingling when he is in the presence of strong wireless radiation. When the pain is bad, he has trouble using his hands, such as for writing or holding a ball or washing. You will notice that they

appear similar to skin reactions to wireless radiation among those who are electrosensitive, in a study by [Belpomme 2020](#).



Unfortunately, I cannot attach pictures of his other symptoms, like headaches, the memory and concentration problems, the feelings of nervousness and agitation, the stomach pains and digestive problems, the sleeping problems, and the severe allergies and frequent respiratory illnesses, but I assure you they are real, and they began after the cell tower at his school was upgraded to 4G LTE in 2013, and they worsened after the second cell tower at his school was upgraded to 4G LTE in 2015. His symptoms only subside when he is away from these high exposures and allowed time to recover. At the very least you should investigate and talk to those who have suffered from microwave sickness and their doctors, since you have received testimonials from others in response to this docket OET 19-226 and previous dockets GN 14-177, IB 15-256, WT RM-11664, WT 10-112, IB 97-95, ET 13-84. You also need to review the thousands of studies showing harmful biological effects from chronic exposures below thermal levels. The FCC should spend as much time in these activities as it does meeting with the wireless industry. It appears that you have not done any of these actions in the decades since the introduction of the cell phone.

The skin is a living organ, and the largest one in our body. It provides physical protection by protecting our inner tissues from germs in our environment and from UV radiation from the sun, functions which require the skin to maintain its structural integrity. It is also tied to the nervous system and the immune system. Per [LeDrean 2013](#), the skin, the nerves and blood vessels in the skin are the main target for mm wave exposure, because more than 98% of the mm wave power density does not penetrate beyond the skin per Fig. 2, meaning that the skin absorbs more than



98% of the radiation. The application of mm waves, even though it has been shown to not penetrate the skin deeply, has been used in medical applications, such as pain reduction. The skin will be receiving unprecedented levels of radiation exposure with the FCC's proposed new limits of 4000 uW/cm<sup>2</sup>, a four-fold increase from its current limit of 1000 uW/cm<sup>2</sup> for 30 minutes. So what could happen to the skin?

The skin is not some dead, inert, plastic barrier. It is full of nerve cells, and it is connected with the immune system. **Abdo 2019** made a discovery of the existence of a neural net of glial/Schwann cells at the epidermal and dermal borders. These cells initiate pain sensations, and from the US government's **NTP 2018** study [https://ntp.niehs.nih.gov/ntp/htdocs/lt\\_rpts/tr595\\_508.pdf?utm\\_source=direct&utm\\_medium=prod&utm\\_campaign=ntpgolinks&utm\\_term=tr595](https://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr595_508.pdf?utm_source=direct&utm_medium=prod&utm_campaign=ntpgolinks&utm_term=tr595) we know that the glial and Schwann cells became cancerous in rats (gliomas and Schwannomas formed) after non-thermal cell phone radiation exposures for 2 years, where cancers were not found in rats that were not exposed to any cell phone radiation. **Louveau et al, 2015** <https://www.nature.com/articles/nature14432> made a discovery that the brain was directly connected to the immune system by lymphatic vessels, where a connection was not known to exist before. This would mean that the immune system can be affected directly by the brain.

A review of studies on the effects of millimeter waves on skin can be found **in Leszczynski, 2020**, which is currently in press.

As early as 1977, biological effects from millimeter waves were found. **Zalyubovskaya 1977**, a CIA document that was classified information until 2012, reported that at a power density of 10,000,000 microwatts/square meter (= 1000 uW/cm<sup>2</sup>, the current FCC exposure guideline for the general public) and frequencies ~ 60 GHz, not only were there negative skin impacts like demyelination of the nerve fibers, but adverse effects were also seen in heart, liver, kidney, spleen tissue as well, and blood and bone marrow properties, despite the shallow penetration of the millimeter waves through the skin. Myelin is the protective sheath for nerve cells, and myelin is composed of glial cells.

Neufeld and Kuster, 2018 <https://pubmed.ncbi.nlm.nih.gov/30247338/> highlights the significant tissue heating generated by 5G technology with rapid short bursts of data transfer on a device, prompting them to call for reevaluation of thermal safety standards (let alone biological standards): *"the peak-to-average ratio of 1,000 tolerated by the International Council on Non-Ionizing Radiation Protection guidelines [which FCC's current guidelines are based] may lead to permanent tissue damage after even short exposures, highlighting the importance of revisiting existing exposure guidelines."*

A summary of the biological effects that can be seen at exposure levels well below 1000 uW/cm<sup>2</sup> from **Bioinitiative, 2012** <https://bioinitiative.org/wp-content/uploads/pdfs/BioInitiativeReport-RF-Color-Charts.pdf>

The adverse biological effects from wireless radiation may be from their effect on cell membranes. **Ramundo-Orlando, 2010** found that cell membranes are considered the major target for the interaction between millimeter waves and biological systems, that the waves may

alter structural and functional properties of membranes (Table 2). **Fragopoulou et al, 2018** found a marker and mechanism for EHS/wireless health effects, i.e. the **cell membrane becomes more permeable from RF exposure by changes in the phospholipid composition**. <https://onlinelibrary.wiley.com/doi/epdf/10.1002/brb3.1001> After a 2hr of 1800 MHz radiation from an actual cell phone in talk mode at a distance of 3 cm (which is calculated to be SAR of 0.02-0.366 W/kg to the head, well under the current FCC limit SAR of 1.6 W/kg, which the FCC is proposing to eliminate in its new rules under docket 19-226), the cell membrane composition was found to be altered significantly, making it more permeable, and altering the expression of 178 genes significantly ( $p < 0.05$ ), revealing an impact on genes involved in critical biological processes, such as cell cycle, DNA replication and repair, cell death, cell signaling, nervous system development and function, immune system response, lipid metabolism, and carcinogenesis.

**Currently, there is more than enough infrastructure to provide cellular services to everyone in the US** since 2013. Per the CTIA, the number of cell towers in the US increased from 66,000 in 1998 to 300,000 in 2013, providing cell service to more than 335 million cell phones in 2013 (104% market penetration in 2013). This exceeds 1 cell phone per person in this country per the CTIA <http://www.ctia.org/your-wireless-life/how-wireless-works/annual-wireless-industry-survey> which has fulfilled the mandate of the 1996 Telecommunications Act.

There is no more justification per the 1996 Telecommunications Act to install any more cell towers than what we already have, including 5G small cell towers, given the above 100% market penetration, which have been estimated will be in the millions.

Some statistics in the news:

- Feb. 24, 2016: [the American Brain Tumor Association has found that brain cancer is the highest cause of cancer deaths in ages 15-39 and the most common cancer among 15-19 year olds](#). There's also been an **increase in Malignant Brain and Central Nervous System Tumors in American children**. For ages 0-14 between 2000-2010, it has increased annually 0.6%/yr. In ages 15-19, between 2000-2008, it has increased annually 1.0%/yr.
- October 2010: [Autism has increased 600% in prevalence over the last two decades](#).
- **ADHD has increased 53% in the US over the last decade** per the CDC. For ages 14 to 17, 19 % of boys and 10% of girls now have ADHD.
- August 2015: Washington Post reports **people are developing dementia a decade earlier compared to 20 years ago (2010 vs. 1990)** The disease is now regularly diagnosed in people in their late 40s and death rates from early onset dementia are soaring. The study found that **deaths caused by neurological disease had risen significantly in adults aged 55 to 74 and more than doubled in the over-75 population overall**. **The problem was particularly acute in the United States, where neurological deaths in men aged over 75 have nearly tripled and in women increased more than fivefold.** *"The rate of increase in such a short time suggested a silent or even a hidden epidemic, in which environmental factors must play a major*

*part, not just aging.*” The environmental factors cited included chemical pollution and increased background electromagnetic fields (which includes wireless radiation)  
[https://www.washingtonpost.com/world/people-are-developing-dementia-earlier-and-dying-of-it-more-a-study-shows/2015/08/06/599b16b8-3c0a-11e5-8e98-115a3cf7d7ae\\_story.html?wprss=rss\\_world](https://www.washingtonpost.com/world/people-are-developing-dementia-earlier-and-dying-of-it-more-a-study-shows/2015/08/06/599b16b8-3c0a-11e5-8e98-115a3cf7d7ae_story.html?wprss=rss_world)

- October 2013: **The NIMH (National Institute of Mental Health) reported 25-30% of kids between ages 13-18 will experience an anxiety disorder. This is an increase of 20 fold (i.e. 1900%) over the last 30 years** <http://health.usnews.com/health-news/health-wellness/articles/2013/10/10/how-to-cope-when-school-anxiety-lingers>
- November 2013: Time Magazine reports that the **rate of reported anxiety disorders among U.S. troops jumped 327% between 2000 and 2012.**  
<http://swampland.time.com/2013/11/05/anxiety-disorders-on-the-rise-in-the-ranks/>
- September 2007: **The number of American children and adolescents treated for bipolar disorder increased 40-fold [that's 3900%!] from 1994 to 2003** The senior author of the study, Dr. Mark Olfson of the New York State Psychiatric Institute at the Columbia University Medical Center, said, ***"I have been studying trends in mental health services for some time, and this finding really stands out as one of the most striking increases in this short a time."*** The increase makes bipolar disorder more common among children than clinical depression, the authors said.  
[http://www.nytimes.com/2007/09/04/health/04psych.html?\\_r=1](http://www.nytimes.com/2007/09/04/health/04psych.html?_r=1)
- **Severe, disabling mental illness has dramatically increased in the United States.** “The tally of those who are so disabled by mental disorders that they qualify for Supplemental Security Income (SSI) or Social Security Disability Insurance (SSDI) increased nearly two and a half times between 1987 and 2007 **For children, the rise is even more startling — a thirty-five-fold [i.e. 3400%!] increase in the same two decades,**” as Marcia Angell summarizes In 1998, Martin Seligman, then president of the American Psychological Association, spoke to the National Press Club about an American depression epidemic: ***"We discovered two astonishing things ... The first was there is now between 10 and 20 times as much of it [depression] as there was 50 years ago. And the second is that it has become a young person's problem. When I first started working in depression 30 years ago ... the average age of which the first onset of depression occurred was 29.5 ... Now the average age is between 14 and 15."***
- In 2011, the **U.S. Centers for Disease Control and Prevention (CDC)** reported that **antidepressant use in the United States has increased nearly 400 percent in the last two decades, making antidepressants the most frequently used class of medications by Americans ages 18-44 years.**  
[http://www.salon.com/2013/08/26/how\\_our\\_society\\_breeds\\_anxiety\\_depression\\_and\\_dysfunction\\_partner/](http://www.salon.com/2013/08/26/how_our_society_breeds_anxiety_depression_and_dysfunction_partner/)
- In May 2013, **CDC** reported in **“Mental Health Surveillance Among Children—United States, 2005–2011,”** the following: ***"A total of 13%–20% of children living in the United States experience a mental disorder in a given year, and surveillance during 1994–2011 has shown the prevalence of these conditions to be increasing."***

Some reports on radiofrequency radiation by the US military and government:



### **NASA Report, 1981**

A NASA report published in April 1981, titled “Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories,” discussed effects of EMF and microwave RF radiation on humans. Effects of microwave radiation reported: headaches, sleep problems, neurological symptoms, cardiac symptoms, memory problems, increased cholesterol, gastritis, ulcers, increased fasting blood glucose, irritability, inability to concentrate, apprehension, and cataracts (clouding of posterior part of lens in those caused by microwave radiation instead of anterior clouding as seen with regular types). Information for the NASA report was collected from over 1,000 written sources that “included journals, conference proceedings, technical reports, books, abstracts, and news items,”

<http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19810017132.pdf>

### **Navy Report, 1971**

On October 4, 1971, the Naval Medical Research Institute published a research report, “Bibliography of Reported Biological Phenomena (‘Effects’) and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation,” which was a compilation of over 2000 references on the biological responses to RF microwave radiation. It lists well over 100 negative biological effects caused by RF microwave radiation - here's a partial list: corneal damage, tubular degeneration of testicles, brain heating, alteration of the diameter of blood vessels, liver enlargement, altered sex ratio of births, decreased fertility, sterility, altered fetal development, decreased lactation in nursing mothers, altered penal function, death, cranial nerve disorders, seizures, convulsions, depression, insomnia, hand tremors, chest pain, thrombosis, alteration in the rate of cellular division, anorexia, constipation, altered adrenal cortex activity, chromosome aberrations, tumors, altered orientation of animals, birds and fish, loss of hair, and sparking between dental fillings. [http://www.magdahavas.com/wordpress/wp-content/uploads/2010/06/Navy\\_Radiowave\\_Brief.pdf](http://www.magdahavas.com/wordpress/wp-content/uploads/2010/06/Navy_Radiowave_Brief.pdf)

### **Air Force Report, 1994**

A June 1994 US Air Force document, titled, “Radiofrequency/Microwave Radiation Biological Effects and Safety Standards: A Review,” **acknowledges the non-thermal health effects.** Stated in its abstract, ***“It is known that electromagnetic radiation has a biological effect on human tissue.”*** The introduction of the report states that ***“researchers have discovered a number of biological dysfunctions that can occur in living organisms”*** and that ***“exposure of the human body to RF/MW [radio frequency/microwave] radiation has many biological implications”*** that range from “innocuous sensation of warmth to serious physiological damage to the eye,” and added that ***“there is also evidence that RF/MW radiation can cause cancer.”*** Biological impacts: ***“damage to major organs, disruption of important biological processes, and the potential risk of cancer,”*** among many others which include ***“mutagenic effects,” “cardiovascular effects,”*** negative effects on chromosomes, and notes that “Soviet investigators claim that exposure to low-level radiation can induce serious CNS [central nervous system] dysfunctions.” <http://www.emfacts.com/2014/09/us-air-force-rf-review-in-1988-acknowledges-non-thermal-biological-effects/> <https://electroplague.files.wordpress.com/2014/09/rf-microwave-radiation-biological-effects-rome-labs.pdf>

FCC's job is to regulate the telecom industry for the protection of this nation's citizens, not loosening exposure guidelines for private industry's gain in the name of national priority when there are serious health risks and unknowns to consider.

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Sincerely,  
Angela Tsiang